

Registration of LGRU *ef* Early Flowering Mutant of Rice

The ARS, USDA, and the Arkansas Agricultural Experiment Station released LGRU *ef* (Reg. no. GP-94, PI 632957), an induced early flowering mutant of rice (*Oryza sativa* L.), in February 2003. The mutant was induced at Stuttgart, AR, in the Arkansas long-grain rice cultivar LaGrue (LGRU) (Moldenhauer et al., 1994). The mutant flowers 16 d earlier but is otherwise phenotypically similar to its parent. Early flowering in this mutant is controlled by a single recessive gene. LGRU *ef* may be useful as a tropical japonica genetic stock or breeding source for early maturity.

Approximately 4000 seeds of the parent cultivar LaGrue were treated with 200 Gy of γ radiation in 1994. The M_1 generation was grown at Stuttgart, Arkansas, and over 1000 random panicles were harvested for a panicle-to-row M_2 generation, which was grown in a 1994–1995 winter nursery. In the winter nursery M_2 generation, LGRU *ef* initially was selected as a putative semidwarf, but when progeny tested at Stuttgart in 1995, it turned out to be a tall line which was segregating for early flowering. No flowering data had been taken in the winter nursery, but it was postulated that the early flowering gene that the mutant carried caused reduced plant height resulting in its selection as a putative semidwarf. Subsequent progeny tests of M_3 generation early flowering plants showed this mutant to be stable for tall plant height and early maturity.

In an eight-replication characterization test at Stuttgart in 1997, LGRU *ef* was 16 d earlier and 3 cm shorter than its parent. The cross LGRU *ef*/LGRU was made in early 1997 and the F_1 was grown in the field the same year, with the F_1 being similar in flowering time as the LGRU parent. An F_2 generation was grown in the winter greenhouse in early 2002, where flowering times were inconclusive. Panicle-to-row progeny tests of 342 F_2 plants, planted at the rate of 21 seeds per row, spaced 30 cm apart within and between rows, were conducted in summer 2002. An average of about 14 plants survived per F_3 row resulting in segregation of 86 rows homozygous early: 165 segregating for flowering with a majority of plants being late: 91 homozygous late. This provided a satisfactory fit ($0.75 < P < 0.90$) to a 1:2:1 segregation ratio characteristic of a single recessive gene for early flowering. Further evidence of the complete recessiveness of this gene was obtained from counting numbers of early flowering and late plants within 64 of the segregating rows. Summed over those 64 rows, there were 237 early flowering: 624 late plants, a satisfactory fit ($0.05 < P < 0.10$) to a 1:3 ratio. Recessiveness of mutations is the general case in plant genetics, although McKenzie et al. (1978) reported an early maturing rice mutant in which early heading was weakly dominant.

In 11 tests between 1999 and 2002, LGRU *ef* yielded 5400 kg ha⁻¹, flowered in 75 d, was 109 cm tall, and showed 29% lodging. In the same tests an early cultivar of similar maturity, 'Maybelle' (MBLE) (Bollich et al., 1991) yielded 5850 kg ha⁻¹,

flowered in 78 d, was 100 cm tall, and showed 6% lodging. In a direct comparison with its parent in four tests in 2002, LGRU *ef* yielded 6860 compared with 9580 kg ha⁻¹ for LGRU. In a 1999 short-duration screening trial, LGRU *ef* yielded 6860 compared with 6510 kg ha⁻¹ for the average of seven Arkansas experimental lines of similar maturity. In a 2000 cropping systems study, LGRU *ef* yielded 6810 compared with 8980 kg ha⁻¹ for the average of nine Arkansas experimental lines of similar maturity, and showed 65% lodging while lodging was observed in only two of the nine experimental lines.

The breeding value of LGRU *ef* may be limited by the yield penalties observed in most tests although the mutant should be tested in different genetic backgrounds by crossing with other materials (MacKay, 1984). This process, which sometimes is called "cleaning up" will help eliminate any detrimental factors linked with the original mutation.

Brown rice grain dimensions were similar to the long grain parent. Apparent amylose content of LGRU *ef* was similar to the parent cultivar LGRU (210–230 g kg⁻¹), as was the intermediate alkali spreading value.

Germplasm amounts of seed (5 g) of LGRU *ef* may be obtained by writing to: J. Neil Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160. Seed also will be placed in the National Small Grains Collection, USDA-ARS, 1691 South 2700 West, Aberdeen, ID 83210, where it is available for research purposes, including development and commercialization of new cultivars. If this germplasm contributes to the development of new cultivars it is requested that appropriate recognition be given to the source.

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References

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- J.N. Rutger and R.J. Bryant, USDA-ARS, P.O. Box 1090, Stuttgart, AR 72160; K.A.K. Moldenhauer, J.W. Gibbons, and M.M. Anders, University of Arkansas, Rice Research and Extension Center, P.O. Box 351, Stuttgart, AR 72160. Registration by CSSA. Accepted 31 Dec. 2003. *Corresponding author (jnrutger@spa.ars.usda.gov).

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